

# HORTICULTURAL SCIENCE

**5132**

**CIP Code: 01.0601**

Horticultural Science is a year long course designed to give students a background in the field of horticulture and its many career opportunities. It addresses the biology and technology involved in the production, processing, and marketing of horticultural plants and products. Topics covered include: reproduction and propagation of plants, plant growth, growth media, floriculture, management practices for field and greenhouse production, marketing concepts, production of herbaceous, woody, and nursery stock, fruit, nut, and vegetable production, and pest management. Students participate in a variety of activities including extensive laboratory work usually in a school greenhouse.

- Suggested Grade Levels: 10-12
- Recommended Prerequisite: Fundamentals of Agricultural Science and Business or by permission of the teacher
- A two credit/two semester course. This course can be offered for a second full year at an advanced level and may also be offered in a two or three hour block for four semesters with a maximum of twelve credit hours.
- This course may fulfill up to two credits of the minimum science requirement for graduation.
- A Core 40 directed elective as part of a technical career area.
- This course qualifies as an Academic Honors Diploma elective.
- Competencies and learning activities defined.
- This course is included as a component of the Agriculture and Natural Resources career cluster and may also be included as a component of the Engineering, Science, and Technologies career cluster.

# PLANT AND SOIL SCIENCE

**5170**

**CIP Code: 02.0401**

Plant and Soil Science is a year long course that provides students with opportunities to participate in a variety of activities including laboratory work. Topics covered include: the taxonomy of plants, the various plant components and their functions, plant growth, plant reproduction and propagation, photosynthesis and respiration, environmental factors affecting plant growth, diseases and pests of plants and their management, biotechnology, the basic components and types of soil, calculation of fertilizer application rates and procedures for application, soil tillage and conservation, irrigation and drainage, land measurement, cropping systems, precision agriculture, principles and benefits of global positioning systems, harvesting, and career opportunities in the field of plant and soil science.

- Suggested Grade Levels: 10-12
- Recommended Prerequisite: Fundamentals of Agricultural Science and Business or by permission of the teacher
- A two credit/two semester course.
- This course may fulfill up to two credits of the minimum science requirement for graduation.
- A Core 40 directed elective as part of a technical career area.
- Competencies and learning activities defined.
- This course is included as a component of the Agriculture and Natural Resources career cluster and may also be included as a component of the Engineering, Science, and Technologies career cluster.

# Horticultural Science

## **A. Students shall examine the methods of plant propagation.**

1. Explain sexual reproduction and discuss the long term benefits and problems to the species with this type of reproduction.
2. Conduct an experiment comparing the environments needed for germination of various seeds and develop appropriate criteria for three types of seeds.
3. Compare and contrast the steps in germination of a monocot and a dicot.
4. Describe the methods used to overcome seed dormancy and relate this problem to attempts to improve crop production in developing countries.
5. Explain the damage done to a root system by improper transplanting techniques, and discuss the correct procedures when transplanting seedlings.
6. Discuss several of the primary differences between monocots and dicots and explain how these differences influence plans for commercial plant propagation.
7. Explain the methods of asexual propagation and identify which species and varieties are best suited to each method.
8. Discuss the roles of vermiculite and perlite in the establishment of a good rooting medium.
9. Describe the uses of synthetic rooting hormones and explain the varying need for such supplementation.
10. Develop a schedule for plant propagation to meet seasonal production demands for plants such as poinsettias. Discuss such constraints as varieties, pot size, type of greenhouse, and overhead.

## **B. Students shall investigate factors in the environment affecting plant growth.**

1. Describe factors to be considered in selecting a greenhouse heating system.
2. Explain how heat effects greenhouse crops and photosynthesis.
3. Discuss the importance of a proper ventilation system to greenhouse crops.
4. Explain how the gaseous components of air in the greenhouse effect plant growth.
5. Examine the effects of agricultural chemicals on air and water pollution. Relate these to environmental concerns of the public.
6. Explain the relationship between greenhouse humidity and plant health. Identify multiple systems for controlling humidity and relate each to specific plant needs.
7. Describe the best match of irrigation systems with type of plant and plant growing medium.
8. Explain the importance of light intensity and duration to plant growth. Cite several examples of plants with differing light needs.

9. Discuss the methods of light control and the effects that each has on plant growth.
10. Describe the effect of light intensity on photosynthesis in greenhouse plants.
11. Compare and contrast an open and a closed environmental system.

**C. Students shall analyze growth media.**

1. Describe the desired characteristics of an ideal growing medium.
2. Develop an argument both for and against the use of amended soil and unamended soil. Identify plants that do best in each type.
3. Discuss the methods of sterilizing soil media and explain the advantages and disadvantages of each method.
4. Describe the effects of proper versus improper watering of plants and relate these to the functions of water in plant growth.
5. Explain porosity of the growing medium and how container size affects root growth.
6. Evaluate different methods of watering greenhouse plants and determine the appropriate method for three specific plants.
7. Describe the advantages and disadvantages of including fertilizer and pesticides in the water supply. Explain how humans must balance environmental concerns with the need and desire for improved plants.
8. Explain the aspect of growth influenced by each of the essential elements needed for plant growth.
9. Describe the deficiency symptoms of three major plant nutrients.
10. Explain the techniques of soil sampling and relate this process to testing the growing medium and interpreting the results to recommend fertilizer applications and pH treatment.
11. Discuss the uses of chemicals to regulate plant growth. Describe the decision-making process related to the use of stimulants, retardants, and rooting hormones.
12. Describe the factors required by micro-organisms in the decomposition of organic matter and relate their actions to the idea of compost.
13. Prepare a persuasive argument to convince a customer to use mulch on newly transplanted Bradford pear trees.

**D. Students shall examine the management practices of field and greenhouse production.**

1. Explain the differences between field production and greenhouse production and the plants produced in each.
2. Describe the use and application of harvest-aid chemicals. Address environmental issues as well as profitability concerns.

3. Discuss the use of chemicals to control rodents and predators in the context of the need for environmental safety and in response to animal rights activists.
4. Generate a plan to water greenhouse and field plants according to selected scheduled times and requirements.
5. Plan a project for growing poinsettias for a money raising event. Determine the location, size, and organization for a greenhouse and select the appropriate plants, supplies, and accessories needed.
6. Identify parts of a greenhouse and describe interior layouts best suited for different plants.
7. Interpret blueprints of a greenhouse or other growing structure and match the proper design to desired use.
8. Prepare a speech for middle school students about safety information found on labels of pesticides and instructions of equipment. Cite examples of different classes of pesticides and appropriate safety measures.

**E. Students shall analyze marketing and market management.**

1. Describe the differences in the levels of marketing and the marketing options available to horticulture producers. Identify advantages and disadvantages of each for specific crop types.
2. Address the problem of packaging and shipping fruits, vegetables, and other horticultural products.
3. Compare three methods of packaging ornamental plants. Describe a specific plan for their marketing in the community.
4. Describe problems associated with warehousing fruits and vegetables. Address the public's concern that tomatoes are always hard and unappealing when picked green. Describe changes that could be made to improve fruit and vegetable quality to the consumer.
5. Explain the benefits of wholesale and retail marketing for a particular product. Describe how these ideas could be used in republics of the former Soviet Union to develop a better consumer food supply.
6. Compare and contrast packaging units commonly used in direct-to-consumer and wholesale markets. Identify specific examples of good and bad usage.
7. Describe the processes used to maintain plant quality during the marketing process.
8. Explain the basic and secondary considerations of market analysis and describe each relative to its importance.
9. Choose a horticultural product and design a market analysis plan specific to it.

**F. Students shall investigate practices used to produce herbaceous, woody, and nursery stock.**

1. Discuss the Indiana definition and the identifiable characteristics of plants known as nursery stock. Identify commonly sold items which are not classified as nursery stock and develop a rationale for this differentiation.
2. Compare the methods and procedures used to propagate nursery stock. Identify specific plants that use each method and describe advantages and disadvantages.
3. Describe the structures, equipment, and material used in the production of nursery stock from an environmentalist point of view. Justify the use of chemicals and other products.
4. Address the maintenance and overwintering storage of nursery stock for various climates.
5. Explain the procedures used to harvest and handle field grown nursery stock. Develop an argument for each method and cite examples of plants for which it is best suited.

**G. Students shall analyze fruit, nut, and vegetable production practices.**

1. Plan an orchard including the necessary steps involved in site selection, soil preparation, plant propagation, and planting.
2. Generate a plan to address common preparation, planting, cultivating, pest, and environmental control problems.
3. Describe unique characteristics of various cultivars that have been recommended for Indiana.
4. Discuss proper harvesting techniques needed for specific plant characteristics.
5. Design a strategy for implementing fruit or vegetable production on the family farm or school land laboratory. Address the timing of planting, planting systems, distance, environmental problems and diseases.
6. Describe the important factors involved with plant selection of fruit and edible nut varieties commonly grown in Indiana.
7. Compare accepted and new practices used in growing fruit, vegetable, and nut varieties. Cite reasons for the new practices and describe how aspects of former procedures have been improved.
8. Use a frost-free map and planting chart to determine planting dates for locally grown fruits, nuts, and vegetables. Develop a proposal to increase production based on the information.
9. Describe methods used to protect plants from freeze and frost damage. Cite examples of those needed in Indiana and southern states for specific crops.
10. Explain the importance of selecting cultivars which are adapted to growing in Indiana and have a high level of consumer demand. Relate this to a market analysis for a specific product.

11. Explain hydroponics and describe the specific difficulties that must be overcome for successful yields.
12. Prepare a plan for a science fair project on hydroponics. Include aspects of pH variance and nutrient level changes.
13. Explain proper pruning techniques that insure healthy, productive fruiting wood and encourage good annual yield of quality fruit. Address the purposes of pruning and tools needed as well as specific practices for each major type of fruit and nut tree.
14. Develop guidelines for effective pest management using the IPM system and philosophy.
15. Describe management practices within the orchard to produce the optimum growth, yield, and maintenance of the orchard site. Include aspects of soil pH and nutrients, fertilization practices, soil texture, and weed control.
16. Describe procedures for picking and storing orchard products to insure a long storage life. Address how these procedures effect the five quality components of fresh produce.
17. Explain insurance requirements for the various types of horticultural businesses.
18. Generate a budget to establish price and profit in fruit and vegetable production.

**H. Students shall explore an environmentally sound pest management system.**

1. Discuss the common pests of horticultural plants and describe the damage inflicted to the plants.
2. Explain the different categories of plant diseases for flowers, vegetables, lawns, trees and shrubs, citing examples for each.
3. Examine the methods used to control plant pests and identify the advantages and disadvantages of each.
4. Prepare a training film for people using pesticides and herbicides to demonstrate the safety procedures and handling requirements. Include the different formulations and label instructions of pesticides as well as dilution ratios for chemicals.
5. Explain how humans become poisoned by pesticides. Describe what systems are affected and the proper first aid procedures for pesticide poisoning.
6. Using non-toxic solutions, design and perform an experiment to calibrate chemical application equipment.
7. Describe the insects known to harm crops in Indiana and discuss insecticide responses to the problem based upon the insect's type of metamorphosis.
8. Discuss the physiological principles of herbicides and relate the action to aspects of plant growth.
9. Describe several harmful insects and how they cause damage to crops. Cite examples of leg, wing, antenna and mouthparts of the most destructive insects.

10. Explain the classification of herbicides and discuss the appropriate uses for each type, citing specific examples.
11. Interpret the impact of current state and federal regulations on pest control measures. Describe how governmental regulations have influenced the quality of fruit and vegetable products in the U.S.
12. Prepare a speech to be given before a student group justifying the need for the Environmental Protection Agency. Address what functions are performed by the EPA and what impact the EPA has had on the life of the average person in the U.S.

**I. Students shall examine career opportunities in horticultural science.**

1. Discuss the variety of careers in horticultural science including growers, workers, and managers and their relative contributions to the industry.
2. Describe the economic importance of the horticultural science industry. Relate current trends to future need for horticultural workers.
3. Choose a specific job in the horticultural field. Determine the educational goals needed to gain employment in that area and requirements for continued employment and advancement.